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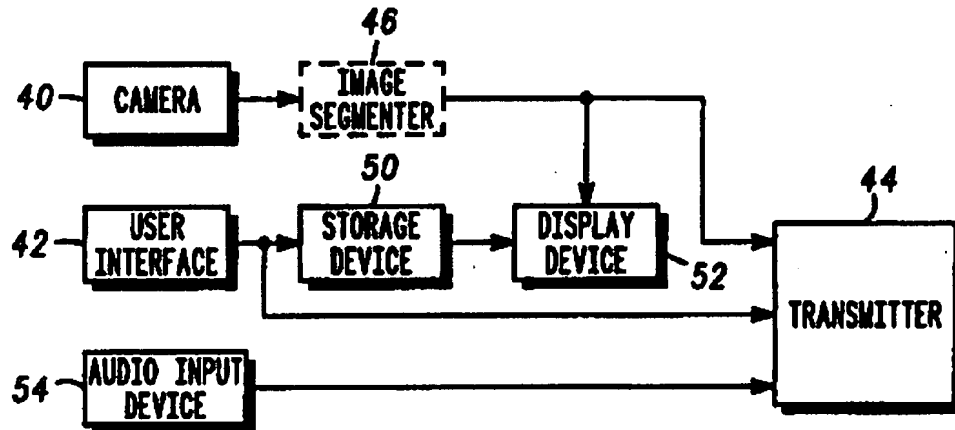
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(54) Title: WIRELESS PAGER WITH PRESTORED IMAGES

(57) Abstract

A system for forming a message for transmission to a wireless pager. The system comprises a camera (30, 40), a user interface (32, 42), storage device (50), audio input device (54), a display device (52), and a transmitter (34, 44). The electronic storage device (50) retrieves an image selected by the user of the interface (32, 42). The system can compose a message (98) having an image (100, 112) accompanied by text.



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WIRELESS PAGER WITH PRESTORED IMAGES

Technical Field

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The present invention relates to a selective call receiver, such as a wireless pager, capable of displaying an image based upon a received signal.

10

Background of the Invention

The use of selective call receivers, such as wireless pagers, is becoming increasingly popular in both personal and business applications. Many currently-available commercial pagers produce either an audio signal or a vibration signal to alert a user of an incoming message. In addition to an alerting signal, many pagers are capable of receiving radio frequency signals representative of a numerical message. These pagers further include a display device capable of displaying the numerical message. This allows a party paging the user to send a return telephone number, for example, directly to the wireless pager.

Other commercially-available pagers are capable of receiving radio frequency signals representative of an alphanumeric message, and displaying the alphanumeric message on a display device. This allows a party paging the user to send a brief text-based message directly to the wireless pager. As a result, pagers with an alphanumeric display provide an improved personalization of an incoming message in comparison to the numerical display.

Other wireless pager systems have been disclosed which provide further personalization of a message received thereby. For example, U.S. Patent No. 5,087,905, to Kuramatsu et al., discloses a radio pager which receives a series of data transmissions and provides a display image based thereupon. In particular, data contained in a second and subsequent ones of the data transmissions is superimposed on basic data contained in a

first of the data transmissions in order to form the display image. A read-only memory is provided for storing a plurality of predetermined patterns, wherein a selected one of the predetermined patterns is displayed in
5 dependence upon the basic data in the first of the data transmissions.

U.S. Patent No. 5,173,688, to DeLuca et al., discloses a pager capable of receiving data representative of a blank form or table and producing a display based
10 thereupon. Further, the pager is capable of filling in the displayed form or table based upon a subsequently received signal.

Brief Description of the Drawings

15

The invention is pointed out with particularity in the appended claims. However, other features of the invention will become more apparent and the invention will be best understood by referring to the following detailed
20 description in conjunction with the accompanying drawings in which:

FIG. 1 is a flow chart of an embodiment of a method of forming a message for transmission to a wireless pager;

FIG. 2 is a block diagram of an embodiment of a
25 system for forming a message for transmission to a wireless pager;

FIG. 3 is a block diagram of another embodiment of a system for forming a message for transmission to a wireless pager;

30 FIG. 4 is a flow chart of an embodiment of a method of reconstructing a message in a wireless pager;

FIG. 5 is a block diagram of an embodiment of a system for reconstructing a message in a wireless pager; and

35 FIGS. 6-10 schematically illustrate examples of combined images in accordance with embodiments of the present invention.

Detailed Description of a Preferred Embodiment

Embodiments of the present invention advantageously
5 form visual messages for a wireless pager based upon both
an image produced by an individual sending a visual
message, and a selected one of a plurality of prestored
images. A significant improvement in the personalization
of messages transmitted to a wireless pager is realized by
10 incorporating the image produced by the individual, and by
providing a variety of prestored images from which the
selected one is chosen. The prestored images may be
utilized in characterizing the nature of the message in
applications such as paging, greetings, and visual mail.

15 FIG. 1 is a flow chart of an embodiment of a method
of forming a message for transmission to a wireless pager.
The method includes a step of capturing at least one image
produced by an individual, as indicated by block 10. The
at least one image preferably contains the face of the
20 individual sending the message, although embodiments of
the present invention are not limited thereto. The at
least one image may comprise a single still image produced
by the individual. Alternatively, the at least one image
may comprise a sequence of images which, when viewed in
25 succession, provide an animated display.

The method further comprises a step of producing a
first signal representative of the at least one image, as
indicated by block 12. Preferably, the first signal is
either an analog or a digital representation of pixels
30 which comprise the at least one image produced by the
individual. If the first signal is to be in a digital
form, the step of producing the first signal may include
steps such as digitizing the at least one image and
encoding an at least one digitized image which results.
35 Further, the first signal in the digital form may be
compressed in order to reduce a number of bits required to
represent the at least one image. For a sequence of

images, various inter-frame compression techniques known in the art of image processing may be employed.

Optionally, the step of producing the first signal representative of the at least one image includes a step
5 of segmenting the at least one image to extract a predetermined object therefrom. As known in the art of image processing, segmenting an image entails subdividing the image into at least one object, wherein an object is representative of a constituent part of the image, a
10 region of the image, or another entity of interest in the image. Preferably, the predetermined object extracted from the at least one image includes a portion of the individual, such as the individual's face. By including a step of segmenting, the first signal provides an encoded
15 representation of the predetermined object rather than the entire image. Various techniques for segmentation may be employed in this step, as one with ordinary skill in the art of image processing will recognize.

As indicated by block 14, the method further includes
20 a step of producing a second signal which indicates a selected image from a plurality of predetermined images. Typically, the selected image is determined based upon a series of keystrokes initiated by the same individual whose image is captured in the step of block 10. The
25 plurality of predetermined images preferably includes one or more clip art images, examples of which are illustrated hereinafter. The selected image is used by the wireless pager which receives the message, in a manner to be described later, to personalize the at least one image
30 produced by the individual.

The second signal need not be an analog or a digital representation of each of the pixels of the selected image. Rather, the second signal is preferably a designator of the selected image from the plurality of
35 predetermined images. More particularly, each of the plurality of predetermined images is uniquely represented by a corresponding designator. Preferably, the designator

for each of the predetermined images comprises a unique series of digital bits.

Optionally, the method may further include a step of producing a third signal in dependence upon a language-based message, as indicated by block 16. The language-based message may be either an audio message, an alphanumeric message, or a combination thereof. The language-based message provides a systematic means of communicating, to the user of the wireless pager, ideas or feelings using conventionalized sounds, signs, or marks having understood meanings.

An audio message in accordance with this step is formed by at least one received acoustic pressure wave. Hence, the third signal is based upon the at least one received acoustic pressure wave for the audio message. Typically, the audio message includes a spoken message by the individual. The audio message may be spoken contemporaneously with the capturing of a sequence of images of the individual, so that a resulting visual message can be synchronized therewith. Alternatively, the audio message may be spoken at a different time than that for capturing the images. Regardless, one is capable of forming a message which comprises an audio message and a visual message associated therewith, based upon both the at least one image produced by the individual and the selected one of the predetermined images.

As a further option, the method may include a step of displaying at least one combined image based upon the at least one image of the individual and the selected image, as indicated by block 20. This step allows the individual to preview the message which is to be transmitted to the wireless pager. Each of the at least one combined image may comprise a corresponding one of the at least one image of the individual superimposed on the selected image. Alternatively, each of the at least one combined image may comprise a first predetermined region and a second predetermined region, wherein the selected image is

displayed in the first predetermined region and each of the at least one image of the individual is displayed in the second predetermined region. Regardless, the at least one combined image may be successively displayed to
5 provide an animated display of the individual.

As indicated by block 22, the method further includes a step of transmitting a signal based upon the first signal and the second signal. The signal may be transmitted to a centrally-located paging computer via a
10 standard telephone connection (either wireless or landline). Upon receiving the signal, the paging computer transmits a radio frequency paging signal, modulated in dependence upon the first signal and the second signal, to the wireless pager. As a result, the visual message
15 formed using the above-described method is transmitted to the wireless pager.

Alternatively, the signal which is transmitted in block 22 may already be a radio frequency signal modulated by the first signal and the second signal. Various
20 modulation techniques may be employed, as one with ordinary skill in the art of communications will recognize. Examples of such modulation techniques include, but are not limited to: amplitude modulation, frequency modulation, phase modulation, pulse amplitude
25 modulation, pulse code modulation, pulse width modulation, pulse position modulation, pulse width modulation, time-division modulation, and frequency division modulation. The radio frequency signal may be directly transmitted to the wireless pager, or alternatively, may be indirectly
30 transmitted to the wireless pager via an intermediate location, such as a paging service provider or a repeater. Generally, the intermediate location is one which receives the radio frequency signal and transmits a second radio frequency signal based thereupon to the wireless pager.
35 If the language-based message, containing either an audio message or alphanumeric message, is to be included,

then the transmitted signal is further based upon the third signal produced in block 16.

FIG. 2 is a block diagram of an embodiment of a system for forming a message for transmission to a wireless pager. The system comprises a camera 30 which captures at least one image of an individual, and produces a first signal representative of the at least one image. The camera 30 may be embodied by one of various devices known in the art; these devices include, but are not limited to: a charge-coupled device (CCD) array, or a vidicon. The camera 30 may capture a single still image of the individual, or alternatively, a sequence of images which provide an animated display of the individual when viewed in succession.

The first signal produced by the camera 30 is preferably either an analog or a digital representation of pixels which form the at least one image of the individual. If the digital representation is utilized, the camera 30 may include a digitizer (not specifically illustrated) which provides the first signal in a digital form. The digital form is preferred in that further image processing hardware, such as an image compressor (not specifically illustrated), may be included to reduce the number of bits required to represent the at least one image.

The system further comprises a user interface 32 which allows the individual to select an image from a plurality of predetermined images. Generally, the user interface 32 may include an input device such as one or more buttons, a keyboard, a mouse, a joystick, a lightpen, a trackball, a touchpad, or a touchscreen, to name a few. In a first preferred embodiment, the user interface 32 includes an array of buttons which allows the individual to select the image by performing a series of keystrokes. In a second preferred embodiment, the individual scans through the predetermined images, by pressing an increment

button and/or a decrement button contained in the user interface 32, until the desired image is selected.

The user interface 32 produces a second signal which indicates the image which is selected by the individual.

- 5 The second signal is preferably a designator of the selected image from the plurality of predetermined images. More preferably, the designator comprises a series of bits which uniquely identifies each of the predetermined images.

- 10 Further included in the system is a transmitter 34 which is responsive to both the camera 30 and the user interface 32. The transmitter 34 transmits the visual message in the form of a third signal based upon the first signal and the second signal. The transmitter 34 may
15 include a modulator which produces the third signal modulated in dependence upon the first signal and the second signal. For example, the transmitter 34 may include a radio frequency modulator which produces a radio frequency signal modulated in dependence upon the first
20 signal and the second signal. This would be beneficial for a wireless system for transmitting the visual message. Alternatively, the modulator may be of the variety which allows signals to be transmitted over a standard telephone line. This may be used for transmitting the visual
25 message to a centrally-located paging computer.

- FIG. 3 is a block diagram of another embodiment of a system for forming a message for transmission to a wireless pager. The system comprises a camera 40, a user interface 42, and a transmitter 44 as in the embodiment of
30 FIG. 2. Optionally, an image segmenter 46 is included in the system. The image segmenter 46 extracts a predetermined object from the at least one image captured by the camera 40. Preferably, the predetermined object includes a portion of the individual, such as the
35 individual's face.

The system further includes an electronic storage device 50 which contains the plurality of predetermined

images in an electronic form. The electronic storage device 50 retrieves the selected image of the predetermined images based upon the second signal produced by the user interface 42. The electronic storage device
5 50 may be a read-only memory, a random-access memory, a magnetic storage device, or a like device. The electronic storage device 50 may be fixed within the system, or may be removable from the system to allow for different predetermined sets of images to be utilized.

10 A display device 52 is coupled to the camera 40 and the electronic storage device 50 to display at least one combined image based upon the at least one image of the individual and the selected image of the predetermined images. The display device 52 preferably comprises a
15 liquid crystal display (LCD) having a pixel resolution sufficient for displaying the combined image. Alternatively, other display devices may be employed as one with ordinary skill in the art will recognize. By including the display device 52, the individual is able to
20 preview the visual message which is to be transmitted to the wireless pager.

As another option, the system may include an audio input device 54 which produces an audio signal based upon an acoustic pressure wave received thereby. Typically,
25 the acoustic pressure wave is a spoken message produced by the individual. The audio input device 54 may be embodied by a microphone or a like transducer. The audio input device 54 is coupled to the transmitter 44 so that the transmitted signal is further based upon the audio signal.

30 As a further option, the user interface 42 may allow the individual to enter an alphanumeric message which augments the visual message. The alphanumeric message can be entered by a series of keystrokes performed by the individual, for example. The user interface 42 converts
35 the alphanumeric message to an electrical signal for application to the transmitter 44, which produces the transmitted signal based thereupon.

The embodiment of FIG. 3 may be realized using a standard videophone. Here, the camera 40, the user interface 42 (a numeric key pad on the videophone may be employed as the user interface 42), the transmitter 44, and the display device 52 are contained within the videophone. A mouthpiece of the videophone may be employed as the optional audio input device 54. The at least one image captured by the camera 40 is transmitted by the videophone to a centrally-located paging computer. The second signal representative of the selected image is transmitted by the videophone using DTMF (dual-tone modulated frequency) signals generated by the numeric key pad. The electronic storage device 50 containing the predetermined images may be located at either the paging computer or the videophone. The at least one combined image, formed either by the paging computer or the videophone, may be displayed on the display device 52 to allow for previewing of the visual message.

FIG. 4 is a flow chart of an embodiment of a method of reconstructing a message in a wireless pager. As indicated by block 60, the method includes a step of receiving a radio frequency signal which contains a first signal representative of at least one image of an individual and a second signal indicative of a selected image of a plurality of predetermined images. The radio frequency signal may be transmitted by a paging service provider, using a ground antenna or a satellite, in response to receiving a visual paging message. As one having ordinary skill in the art will recognize, the radio frequency signal typically contains an identification signal which identifies which wireless pager is to receive the message.

The method further includes a step of extracting the first signal and the second signal from the radio frequency signal, as indicated by block 62. If the radio frequency signal is modulated in dependence upon the first signal and the second signal, this step entails

demodulating the radio frequency signal to extract the first signal and the second signal. The first signal is preferably either an analog or a digital representation of the pixels of the at least one image of the individual.

5 The second signal is preferably a designator of a selected image of a plurality of prestored images. Most preferably, the second signal comprises a series of digital bits which uniquely identifies each of the prestored images.

10 A step of retrieving the selected image from the prestored images based upon the second signal is performed, as indicated by block 64. Preferably, this step results in providing a digital representation of pixels contained in the selected image.

15 As indicated by block 66, a step of displaying at least one combined image based upon the at least one image of the individual and the selected image is performed. If the first signal is a compressed, digital signal, the step of displaying includes a step of decompressing the first
20 signal. Each of the at least one combined image may comprise a corresponding one of the at least one image of the individual superimposed on the selected image. Alternatively, each of the at least one combined image may comprise a first predetermined region and a second
25 predetermined region, wherein the selected image is displayed in the first predetermined region and each of the at least one image of the individual is displayed in the second predetermined region. Regardless, the at least one combined image may be successively displayed to
30 provide an animated display of the individual.

Optionally, if the radio frequency signal contains a signal representative of an audio message, then a further step of producing at least one acoustic pressure wave representative of the audio message may be performed, as
35 indicated by block 70. Here, the at least one combined image may be displayed in synchronization with the at

least one acoustic pressure wave, so that the visual message and the audio message are synchronized.

As another option, if the radio frequency signal contains a signal representative of an alphanumeric message, then a further step of displaying the alphanumeric message may be performed, as indicated by block 72.

FIG. 5 is a block diagram of an embodiment of a system for reconstructing a message in a wireless pager. A receiver 80 receives a radio frequency signal which contains a first signal representative of at least one image of an individual and a second signal indicative of a selected image of a plurality of predetermined images. Further, the radio frequency signal typically contains an identification signal which identifies which wireless pager is to receive the message. Hence, the wireless pager typically includes hardware responsive to the identification signal for detecting which messages are to be reconstructed therein.

If the radio frequency signal is modulated in dependence upon the first signal and the second signal, then the receiver may include a demodulator (not specifically illustrated), as is known in the art. The demodulator acts to extract the first signal and the second signal from the radio frequency signal based upon a predetermined modulation scheme which is utilized.

The receiver 80 provides the second signal to an electronic storage device 82 which contains the predetermined images in an electronic form. The electronic storage device 82 retrieves the selected image of the predetermined images based upon the second signal. The electronic storage device 82 may include a read-only memory, a random-access memory, a magnetic storage device, or a like device. The electronic storage device 82 may be fixed within the wireless pager, or may be removable to allow for different predetermined sets of images to be utilized.

The first signal from the receiver 80 and the selected image from the electronic storage device 82 are communicated to a display device 84. The display device 84 displays at least one combined image based upon the at least one image of the individual and the selected image. The display device 84 may be capable of successive displaying a series of combined images to provide an animated display of the individual. Alternatively, the display device 84 may only display a single combined image based upon a still image of the individual. The display device 84 preferably comprises a liquid crystal display (LCD) having a pixel resolution sufficient for displaying the at least one combined image. Alternatively, other display devices may be employed as one with ordinary skill in the art will recognize.

More preferably, the display device 84 has sufficient pixel resolution so that the image of the individual may be recognized by the recipient of the visual message. Further, the display device 84 is preferably capable of displaying a sufficient number of different pixel intensity levels and/or colors so that the image of the individual may be recognized.

Optionally, if the radio frequency signal contains a signal representative of an audio message, the system may further include an audio output device 86 which produces at least one acoustic pressure wave representative of the audio message. Here, the receiver 80 extracts the signal representative of the audio message from the radio frequency signal for application to the audio output device 86. The audio output device 86 may include a speaker or any like transducer capable of producing acoustic pressure waves in response to an electrical signal applied thereto.

The at least one combined image may be displayed in synchronization with the at least one acoustic pressure wave so that the visual message and the audio message are synchronized. For example, a sequence of combined images

may be successively displayed to corresponding with a spoken message from the individual.

Optionally, if the radio frequency signal contains a signal representative of an alphanumeric message, then the display device 84 may further display the alphanumeric message in addition to the at least one combined image. Here, the receiver 80 extracts the signal representative of the alphanumeric message for application to the display device 84.

Although not specifically illustrated, the system for reconstructing the message may be used in conjunction with other hardware contained within a wireless pager. The wireless pager may include a memory for storing received messages, and a user interface which allows a user to step through received messages for display on the display device 84. In order to store the visual messages, the memory may store pixel representations of the combined images. Alternatively, the memory may store representations of the first and second signals; e.g., the memory stores pixel representations of the image of the individual and the designator of the selected image.

FIGS. 6-10 schematically illustrate examples of combined images in accordance with embodiments of the present invention. Examples of the prestored, predetermined clip art images include: a letter-head image 90, an example of which is illustrated in FIG. 6; a border image 92, an example of which is illustrated in FIG. 7; a graphics image 94, an example of which is illustrated in FIG. 8; a scenic image 96, an example of which is illustrated in FIG. 9; and a message-slip image 98, an example of which is illustrated in FIG. 10. An image 100 of the individual is included in each of the examples of combined images.

If the individual forming the visual paging message is representing a business or a personal concern, he/she may choose a suitable letter-head image 90 or a like image to form the visual message. The letter-head image 90 may

graphically contain the name of the business or personal concern.

5 The individual may select a suitable border image 92 or graphics image 94 to embellish the visual paging message. If the individual forming the visual paging message is on vacation, for example, he/she may choose a suitable scenic image 96 or a like image to form the visual message. The scenic image 96, and more generally any of the clip-art images, may be captured by a camera and/or artistically created.

10 The individual may select the message-slip image 98 to provide a conventional "while you were out" type visual message. Here, various message-slips may be selected having different illustrations which characterize the message. For example, different message-slips may contain characterizations such as "urgent", "personal", "call back", and "will call again". The message-slip image 98 may include fields which allow an alphanumeric message entered by the individual to be displayed.

20 As earlier described, the image 100 of the individual may be superimposed on the selected clip-art image to form the combined image. This is illustrated in FIG. 8 and FIG. 9 wherein the image 100 is superimposed on the graphics image 94 and the scenic image 96. Alternatively, 25 the image 100 may be displayed in one predetermined region, while the selected clip-art image is displayed in another predetermined region. This is illustrated in FIG. 6, 7, and 10. In FIG. 6, the letter-head image 90 is displayed in a region 104 above another region 106 which contains the image 100 of the individual. In FIG. 7, the border image 92 is displayed in a region 108 which surrounds another region 110 containing the image 100 of the individual. In FIG. 10, the image 100 of the individual is contained in a predetermined region 112 in 30 the message-slip image 98.

A multitude of different clip-art images may be utilized to personalize a visual message in embodiments of

the present invention. Other clip-art images which may be popular include greeting-card-type images for various occasions and sports-highlights images. Consequently, embodiments of the present invention may be applied in a variety of applications which include paging, greetings, and visual mail.

Thus, there has been described herein a concept, as well as several embodiments including a preferred embodiment of a wireless pager with prestored images.

10 Because the various embodiments of methods and systems for forming and reconstructing a visual message as herein-described utilize a prestored clip art image along with a captured image, they provide a significant improvement in personalizing a visual message which is transmitted to a wireless pager.

15 Additionally, the various embodiments of the present invention as herein-described use clip art images to characterize the nature of the paging message, such as being urgent or personal.

20 It will be apparent to those skilled in the art that the disclosed invention may be modified in numerous ways and may assume many embodiments other than the preferred form specifically set out and described above.

25 Accordingly, it is intended by the appended claims to cover all modifications of the invention which fall within the true spirit and scope of the invention.

Claims

1. A system for forming a message for a wireless pager, the system comprising:

5 a camera which captures at least one image, the camera producing a first signal representative of the at least one image;

10 a user interface which allows an individual to select a selected image from a plurality of predetermined images, the user interface producing a second signal which indicates the selected image; and

a transmitter, in communication with the camera and the user interface, which transmits a third signal based upon the first signal and the second signal.

15

2. The system of claim 1 wherein the third signal is a radio frequency signal modulated in dependence upon the first signal and the second signal.

5 3. The system of claim 1 further comprising a display device, in communication with the camera, which displays the at least one image.

10 4. The system of claim 3 further comprising a storage device which contains the plurality of predetermined images, the storage device communicating with the user interface to retrieve the selected image based upon the second signal, wherein the selected image is communicated to the display device, and wherein the
15 display device displays at least one combined image based upon the at least one image and the selected image.

20 5. The system of claim 4 wherein each of the at least one combined image has a corresponding one of the at least one image of the individual superimposed on the selected image.

25 6. The system of claim 4 wherein the selected image is displayed in a first predetermined region of each of the at least one combined image, and each of the at least one image of the individual is displayed in a second predetermined region of the at least one combined image.

30 7. The system of claim 1 further comprising an audio input device which produces a fourth signal in dependence upon at least one acoustic pressure wave received thereby, wherein the third signal transmitted by the transmitter is further based upon the fourth signal.

8. A system for forming a message for a wireless pager, the system comprising:

a camera which captures at least one image of an individual;

5 an image segmenter which extracts a predetermined object from each of the at least one image of the individual, the image segmenter producing a first signal representative of the predetermined object;

10 a user interface which allows the individual to select a selected image of a plurality of predetermined images, the user interface producing a second signal which indicates the selected image;

15 a storage device which contains the plurality of predetermined images, the storage device communicating with the user interface to retrieve the selected image based upon the second signal;

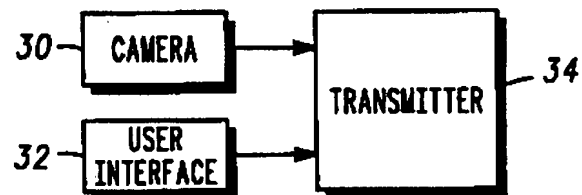
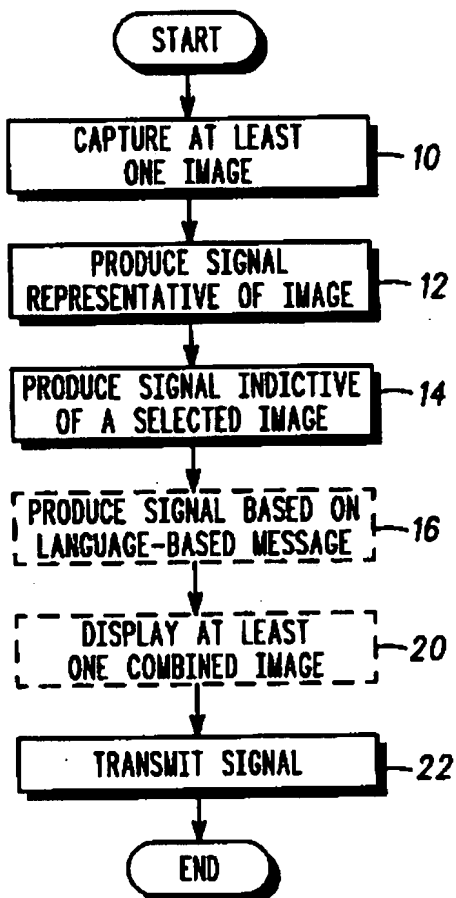
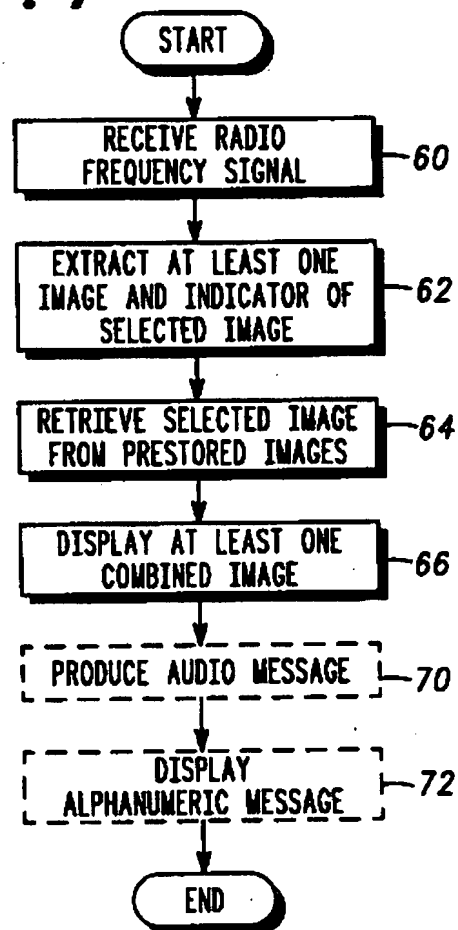
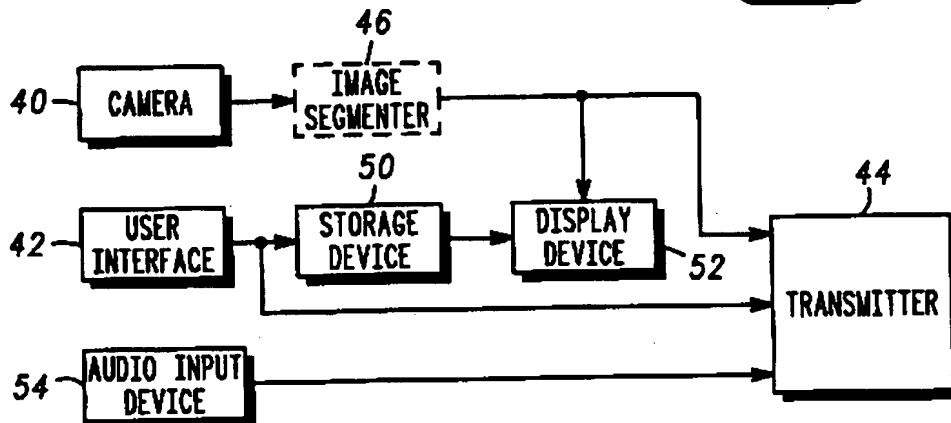
20 a display device in communication with the image segmenter and the storage device, the display device displaying at least one combined image based upon the predetermined object and the selected image; and

a transmitter, responsive to the camera and the user interface, which transmits a radio frequency signal modulated in dependence upon the first signal and the second signal.

25

9. A method of forming a message for a wireless pager, the method comprising the steps of:
- capturing at least one image of an individual;
 - producing a first signal representative of at
 - 5 least a portion of each of the at least one image of the individual;
 - producing a second signal which indicates a selected image from a plurality of predetermined images;
 - and
 - 10 transmitting a third signal based upon the first signal and the second signal.

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FIG. 2*FIG. 1**FIG. 4**FIG. 3*

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FIG. 5

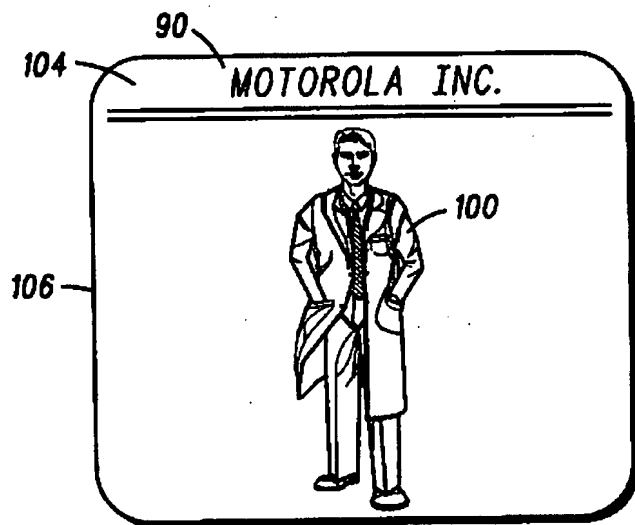
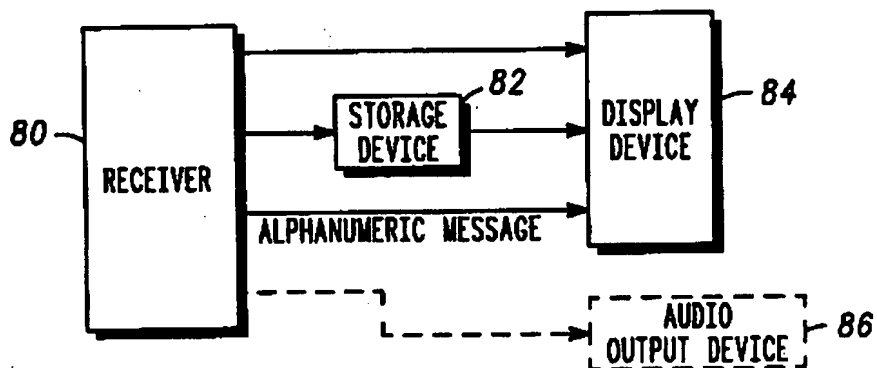


FIG. 6

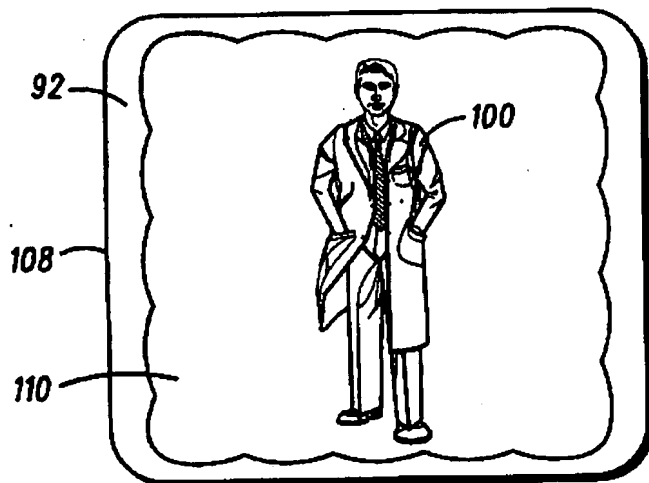


FIG. 7

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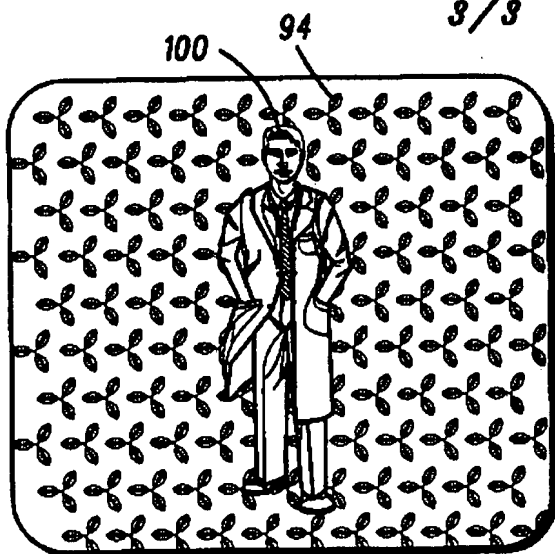


FIG. 8

FIG. 9

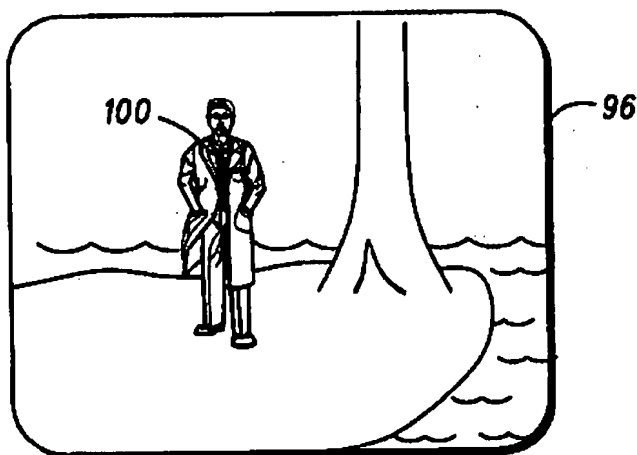


FIG. 10

100

112

DATE: _____

TIME: _____

URGENT

MESSAGE: _____

98

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US95/14693**A. CLASSIFICATION OF SUBJECT MATTER**

IPC(6) : G08B 5/22

US CL : 364/514R; 340/ 825.44, 311.1; 395/147

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 364/514R; 340/ 825.44, 311.1; 395/147

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X,P	US, A, 5,426,594 (WRIGHT ET AL.) 20 June 1995, col. 6, lines 5-68.	1-9
Y,P	US, A, 5,446,678 (SALTZSTEIN ET AL.) 29 August 1995, col.4, lines 1-68.	1-9
A	US, A, 5,087,905 (KURAMATSU ET AL.) 11 February 1992.	1-9
A	US, A, 5,173,688 (DELUCA ET AL.) 22 December 1992.	1-9

☐ Further documents are listed in the continuation of Box C.
 ☐ See patent family annex.

* Special categories of cited documents:		T later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention	
A document defining the general state of the art which is not considered to be part of particular relevance		*X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone	
B earlier document published on or after the international filing date		*Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art	
L document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)		*A* document member of the same patent family	
O document referring to an oral disclosure, use, exhibition or other means			
P document published prior to the international filing date but later than the priority date claimed			

Date of the actual completion of the international search 19 JANUARY 1996	Date of mailing of the international search report 20 February 1996 (20.02.96)
Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703) 305-3230	Authorized officer Joni Hill ELLIS B. RAMIREZ Telephone No. (703) 305-3800